

CLAIMS

What is claimed is:

- 1 1. A method of providing a single console control point for a network device cluster, wherein the cluster comprises a first switch device, a plurality of active routers, one or more standby routers, and a second switch device, the method comprising the computer-implemented steps of:
 - 5 receiving user input specifying an operation to perform on the cluster as a whole; and
 - 6 automatically performing the specified operation on one or more of the active routers
 - 7 in the cluster by transforming the specified operation into one or more device-specific operations for each of the one or more active routers.
- 1 2. A method as recited in Claim 1, wherein the receiving step comprises receiving user input specifying a configuration command for the cluster; and wherein the performing step comprises automatically communicating the configuration command to each of the active routers in the plurality of active routers.
- 1 3. A method as recited in Claim 2, further comprising the steps of:
 - 2 subscribing a management process to an event bus;
 - 3 subscribing each of the active routers to the event bus; and
 - 4 publishing the configuration command in an event on the event bus.
- 1 4. A method as recited in Claim 3, further comprising the steps performed at each of the active routers of:
 - 3 receiving the event;
 - 4 extracting the configuration command from the event; and
 - 5 presenting the configuration command to a native console.
- 1 5. A method as recited in Claim 2, wherein the configuration command is a configuration load command.

1 6. A method as recited in Claim 2, wherein the configuration command is a
2 configuration execution command.

1 7. A method as recited in Claim 2, wherein the user input is received in a graphical user
2 interface, and further comprising the step of displaying an execution log for the configuration
3 command within the same graphical user interface in which the user input is received.

1 8. A method of providing a single console control point for a network device cluster,
2 wherein the cluster comprises a first switch device, a stack consisting of one or more active
3 routers and one or more standby routers, and a second switch device, the method comprising
4 the computer-implemented steps of:

5 receiving first user input requesting an operational overview of the cluster; and
6 generating and displaying an operational overview of the cluster, wherein the
7 operational overview comprises a status indicator, connection information,
8 failed device information, and a first access icon for accessing information
9 about the stack.

1 9. A method as recited in Claim 8, further comprising the steps of:
2 receiving second user input that selects the first access icon;
3 generating and displaying a device operational overview for devices in the cluster,
4 wherein the device operational overview comprises, for each router in the
5 stack of the cluster, a device status indicator, device connection information,
6 failed connection information, and a second access icon for accessing
7 information about connections of the switch devices and the stack.

1 10. A method as recited in Claim 8, further comprising the steps of:
2 receiving third user input that selects the second access icon;

3 generating and displaying a connection operational overview for connections of the
4 cluster, wherein the connection operational overview comprises, for each
5 connection of the stack, a connection status indicator and one or more values
6 of attributes associated with the connection.

1 11. A method of providing a single console control point for a network device cluster, the
2 method comprising the computer-implemented steps of:
3 receiving first user input in a user interface (UI) that identifies a first switch device
4 and a second switch device for a network device cluster;
5 receiving second user input in the UI that identifies a plurality of network elements
6 for a router stack of the cluster;
7 receiving third user input in the UI that defines at least one first connection of the first
8 switch device in association with at least one network element in the stack,
9 and at least one second connection of the second switch device in association
10 with at least one network element in the stack; and
11 associating the first, second, and third user input in a cluster object that
12 programmatically represents the cluster.

1 12. A method as recited in Claim 11, further comprising the steps of:
2 receiving information specifying that a network element in the cluster has failed;
3 based on the cluster object, selecting a substitute network element from among one or
4 more available network elements from the router stack;
5 receiving connection configuration information from the identified network element;
6 and
7 based on the connection configuration information, re-configuring the substitute
8 network element and the one or more switch devices associated with the
9 identified network element, wherein the re-configuring causes the one or more
10 switch devices to change one or more connections from the identified network
11 element to the substitute network element.

1 13. A method as recited in Claim 12, wherein the step of re-configuring the substitute
2 network element and the one or more switch devices associated with the identified network
3 element further comprises the steps of:

4 creating one or more sets of commands to configure the one or more switch devices;
5 and
6 publishing a configuration load event that includes the commands and that targets
7 only the one or more switch devices associated with the identified and
8 substitute network elements.

1 14. A method as recited in Claim 13, wherein the step of re-configuring the substitute
2 network element and the one or more switch devices associated with the identified network
3 element further comprises the steps of:

4 in response to the configuration load event, each of the one or more switch devices
5 connecting to the cluster manager and receiving a particular set of commands;
6 at each of the one or more switch devices, processing the particular set of commands,
7 wherein processing includes causing the one or more switch devices to change
8 the one or more connections from the identified network element to the
9 substitute network element; and
10 at each of the one or more switch devices, publishing a configuration complete event
11 to acknowledge completing the processing of the particular set of commands.

1 15. A method as recited in Claim 11, wherein the third user input includes information
2 defining a set of commands used to reconfigure at least one switch device from the plurality
3 of switch devices.

1 16. A method as recited in Claim 11, wherein the first, second and third user inputs are
2 stored persistently at a cluster manager; and wherein each of the plurality of switch devices
3 and the plurality of network elements persistently stores startup configuration information,
4 but does not store the first, second and third user inputs.

1 17. A method as recited in Claim 11, wherein the second user input comprises
2 information identifying one or more network elements from the plurality of network elements
3 as back-up network elements.

1 18. A method as recited in Claim 11, wherein the second user input comprises
2 information identifying one or more network elements from the plurality of network elements
3 as stand-by network elements.

1 19. A method as recited in Claim 11, further comprising the step of receiving a fourth
2 user input in the UI that modifies information received in the second and third user inputs.

1 20. A method as recited in Claim 11, further comprising the step of receiving a fourth
2 user input in the UI that identifies at least one network element as removed from the plurality
3 of network elements.

1 21. A method as recited in Claim 11, further comprising the step of receiving a fourth
2 user input in the UI that disassociates at least one switch device from the plurality of switch
3 devices with at least one network elements from the plurality of network elements.

1 22. A method as recited in Claim 11, wherein the first, second, and third user inputs
2 define a logical stack object, wherein the logical stack object is identified by a stack name
3 and represents a logical grouping of at least two switch devices and at least one network
4 element.

1 23. A method as recited in Claim 22, further comprising the step of receiving a fourth
2 user input in the UI that requests sending a command to all switch devices and all network
3 elements represented by the logical stack object.

1 24. A user interface (UI) located at a user device for use in providing a single console
2 control point for a network device cluster, comprising:
3 an input mechanism for receiving user input, wherein the user input includes:
4 a first user input that identifies a plurality of switch devices in a logical stack
5 object that represents the network device cluster;
6 a second user input that identifies a plurality of network elements in the
7 network device cluster; and
8 a third user input that associates at least one switch device from the plurality
9 of switch devices with at least one network element from the plurality
10 of network elements; and
11 an execute mechanism for causing re-provisioning of real network elements that are
12 represented by the logical stack object.

1 25. A user interface as recited in Claim 24, wherein the execute mechanism comprises
2 instructions which, when executed by a processor, cause the processor to perform the steps
3 of:
4 identifying a network element that has failed;
5 selecting a substitute network element from among one or more available network
6 elements from the plurality of network elements;
7 receiving connection configuration information from the identified network element;
8 and
9 based on the connection configuration information, re-configuring the substitute
10 network element and the one or more switch devices associated with the
11 identified network element, wherein the re-configuring causes the one or more
12 switch devices to change one or more connections from the identified network
13 element to the substitute network element.

1 26. An apparatus for providing a single console control point for a network device
2 cluster, wherein the cluster comprises a first switch device, a plurality of active routers, one
3 or more standby routers, and a second switch device, the apparatus comprising:
4 means for receiving user input specifying an operation to perform on the cluster as a
5 whole; and
6 means for automatically performing the specified operation on one or more of the
7 active routers in the cluster by transforming the specified operation into one or
8 more device-specific operations for each of the one or more active routers.